Acknowledments

First, I would like to thank Prof. Raúl Rojas for being my supervisor. I am very grateful for his guidance, encouragement, and for supporting this work.

I would also like to kindly thank Prof. Randolf Menzel for taking over the part of the second referee.

My thanks go to all members of the Artificial Intelligence Group of Free University Berlin as well as all the people of the academic and support staff of the Computer Science Institute for such a nice stimulating environment, embedded in the exciting research context of Berlin.

I am indebted to the E-Chalk team for having developed the tools and interfaces needed for integration my simulation system with a modern E-teaching system. Lars Knipping wrote the API for coupling external applications to E-Chalk. Ernesto Tapia provided the handwriting recognizer used in my system as integrated with E-Chalk.

For showing the application of my simulation system, the model of a real neurobiological system was suggested based on the experimental results. I owe a great deal to Björn Brembs for the grateful discussion about results of modelling tests.

I express my thanks all members of the Postgraduate Research Program "Signal Cascades in Living Systems". To be a member of this program gave me a chance of finding possible research directions included such fields as computer science and neuroscience.

This research was funded by the German Research Society, Postgraduate Research Program "Signal Cascades in Living Systems" (DFG grant GRK 120).

On a personal note, I want to say thank you to my parents for their patience, believe in me and guide me to independence.

Most importantly, I thank my husband Oleg for his moral support, warmth and love.

I thank all my friends for the time together and making me feeling nice.